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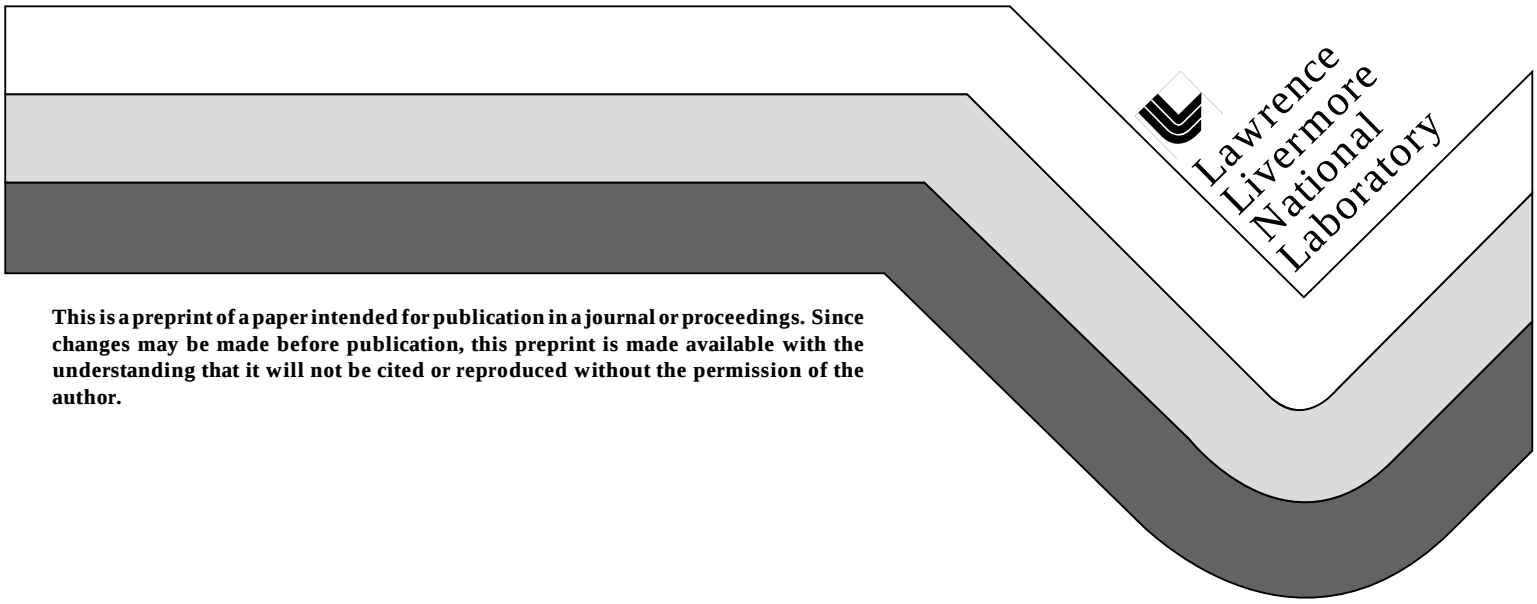

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MANAGING SAFETY IN A RESEARCH AND DEVELOPMENT ENVIRONMENT[1]

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Abstract

A method for managing safety in a research and development environment is described which involves both the subject matter experts and the researchers in development of safety policy and implementation planning. This method has been used effectively at LLNL to maximize safety benefits while minimizing the costs of the safety program and aggravation to the researcher. A product of this effort is the establishment of an effective safety culture as the line organizations work with the subject matter experts to develop and implement the safety program.

1 INTRODUCTION

Managing safety and providing the necessary safety culture has become an increasingly complex task for those involved in research and development (R&D) activities such as at a National Laboratory. This is particularly true for facilities dealing with radioactive materials but also for facilities with chemical, toxic or biological hazards. The reason for this increasing complexity is the rising demand for safety assurance being voiced by the public and their elected representatives which is reflected in the actions of regulatory agencies and other government bodies. The result is that effort is being diverted from research activities to deal with safety assurance in an era when research budgets are decreasing. This situation not only inhibits the researcher but places a burden on the safety professionals to deal with compliance issues while continuing to monitor important safety functions in the workplace. The situation can be alleviated by careful development and implementation of policy and guidance and the nurturing of a positive safety culture.

2 APPROACH

A successful R&D organization requires a certain amount of flexibility in organizational structure depending on the particular technology and disciplines involved. Rather than a top down management approach many research

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organizations employ a more collegial style, relying on collective or distributed decision making instead of commands from the top. This organizational style becomes more necessary when budgets for the research institution come from multiple sources, each of which tries to exercise some control over the activities on which its funds are spent.

The regulators and oversight bodies, of course, would prefer to deal with a more monolithic organization, where responsibilities are clearly defined and safety activities are exercised in a uniform fashion across the institution. One way to approximate this, and at the same time minimize duplication (separately developed action plans and implementation guides for each research element), is to have the safety professional develop policy and guidance which is then reviewed and approved collectively by representatives from each of the research elements. The policies are then implemented by the research elements from an informed basis.

If this can be done in a timely matter then an added benefit is the buy-in obtained from the implementing (research) elements who have been a party to the very policy and guidance they must implement. The challenge is to balance the natural tension which develops between the researchers, who may want to do less to conserve budget, and the safety professionals, who want to do more so as to maximize safety and assure compliance with laws and regulations.

Basic to this balancing of tension is the use of risk-based methods for prioritizing safety activities so that the research (line) organizations feel they are getting the most for the effort expended. Risk-based methods also have the benefit of providing a defense when compliance activities must be deferred because of budget pressures.

2.1 Developing a Strategy

Rather than await direction from the regulators it is necessary to develop an institutional strategy for conducting a safety program based on the needs of the organization. The strategy must be documented so that the institution's personnel, as well as oversight groups, can understand it. Such a document(s), and all documents used to assure regulatory compliance, should be made as useful and user friendly as possible. In developing the safety program it must be kept in mind that the true objective is to maximize safety, not to just prove compliance.

The U.S. Department of Energy (DOE) is currently piloting a strategy for identifying safety standards to be used in a safety program for individual DOE sites and facilities. Called Necessary and Sufficient (N&S) this strategy asks for each site/facility to identify the safety standards applicable to it which are necessary and sufficient to assure adequate safety. These standards are selected, based on the type of activity undertaken, from national consensus standards, where possible, or those developed at a particular site. A team composed of subject matter experts and operations personnel from the site/facility are used to select the appropriate standards. These are then approved by a peer review group and subsequently by the DOE. The operating contractor then develops a safety program at his site/facility to assure that operations are conducted to meet this necessary and sufficient set of standards. Not only does this process involve the operator in identifying the appropriate standards under which to operate but it identifies only those standards which are needed to assure safety at the particular site/facility in

question. Pilot applications of the N&S process are underway and guidance for its implementation at all sites/facilities is being developed.

3 METHODS

To make the approach outlined above work, various elements have to be put in place to exercise a plan-do-check-adjust cycle. At the top sits a body composed of senior managers, e.g., director, associate directors, major department heads, which makes policy and adjudicates unresolved conflicts from lower tier elements in the organization. This body may be called an Environmental, Safety and Health (ES&H) Council or Senior Management Council. It is important that this body meets regularly, gives prompt and clear decisions and is perceived as championing safety.

Below this body of senior managers are various Working Groups or Committees which actually work out the policies and communicate them to the research organizations. These second tier bodies do most of the work and must operate on tight schedules. It is here where consensus is achieved or the majority prevails. Issues that can't be resolved at this level are elevated to the senior managers but all attempts should be made to resolve issues at the lower level. An effective way to force a consensus is to require that those dissenting from the majority view defend their position before the senior managers.

Since members of the Working Groups spend only a limited amount of time on Working Group activities they must rely on subject matter experts in the ES&H support organizations, e.g., health and safety department, environmental compliance department, to initially develop policy options and implement guidance. These subject matter experts must be placed on an equal footing with the representatives of the research elements as befits their status as qualified professionals.

Finally, reviews need to be conducted of safety program activities so that both top management and the safety program implementors can see how they are doing. These reviews include both line management self-assessment and assessments made by those independent of the line. as a cross-check Those closest to the line organizations are in the best position to judge the effectiveness of their safety activities but some form of independent check by the institution is needed to see that the self assessments are done fairly and the results reported. The results of these assessment activities are then reviewed to make adjustment to policy and its implementation.

4 ISSUES

After putting in place the safety culture described above a number of potential pitfalls become apparent.

4.1 Safety Versus Compliance

First and foremost is the need to keep the achievement of adequate safety of the public and workers as the goal and not focus exclusively on attaining compliance. In some cases compliance with certain directives may be money misspent to the detriment of achieving other, more important safety goals. An example would be to spend money to replace signs denoting hazards in the work place so as to conform to a uniform color standard rather than spending money to mitigate and monitor the hazard to which the sign refers.

4.2 Prioritization Pitfalls

Another difficulty is to make prioritization stick. In our Plant Operations Directorate, which provides ES&H and facility support to the Laboratory, we have used a "risk totem" approach [1] as well as a more complex, multi-attribute utility theory (MAUT) approach [2,3] to prioritize overhead expenditures on ES&H support and corrective actions. The "risk totem" concept calls for assigning a letter or number to each task for each of three variables, probability, consequence and cost. For instance, if an A is assigned for the highest probability, highest consequence, and lowest cost, then the AAA task(s) would have top priority. The more complex MAUT approach makes use of a utility function which reflects management's value judgment about the relative desirability of risk reduction in each of ten areas, e.g., employee health and safety, worker health and safety, environmental protection. By aggregating the scores in each area for the various tasks a relative priority ranking can be obtained for each task.

We have used these different prioritization methods to prioritize the expenditure of funds for safety, only to have the rankings overturned because of arbitrary deadlines imposed by regulators. In spite of this, prioritized ranking of activities is useful because it indicates where you should maximize your effort even if you cannot eliminate some activities completely.

4.3 Role of Oversight

One of the most difficult aspects of nurturing a safety culture in a research laboratory is to provide the proper level of oversight to see that safety is being accomplished while not inhibiting the research or unwittingly transferring safety responsibility from the research organizations line management to the oversight group. In any safety culture, line management must be responsible and held accountable for their organization's safety. At the same time there must be an independent check, ideally in a constructive and cooperative manner, to assure top management and sponsoring agencies that an adequate level of safety is being maintained. A light but firm hand must be used by the oversight group to strike the appropriate balance between these conflicting goals.

A method for accomplishing these goals is by the use of performance measures which are assessed on a periodic basis. The University of California, in the management of its three DOE National Laboratories, has been successfully using performance measures to assess their performance. Performance measures are established and mutually agreed to at the start of the assessment period and performance against these measures is assessed at the end of the period. Numerical grades are assigned for each measure based on previously agreed to criteria and aggregated to provide an overall grade. The salary increases for laboratory top

management are based on this grade. The advantage in using performance measures is that it removes some of the subjectivity found in many assessment activities and provides reward or punishment through the salary setting process, thus giving incentive for good performance. The disadvantage is that performance measures can never be comprehensive enough to cover all areas of safety nor does meeting the measures assure that safety is being properly managed. Performance measures are useful but not the whole answer for accomplishing oversight. Self assessment by the line organizations is also necessary.

A valuable product of any oversight effort is the lessons learned from assessment activities. These need to be shared with management at all levels so that any redirection or tailoring of effort is facilitated. Where possible, tracking and trending of deficiencies found can also provide useful information.

4.4 Motivation

Finally, it is important to work to keep personnel motivated in light of ever changing requirements and demands. Leadership displayed by top management can play an important role in this process by offering encouragement and support at the appropriate times.

5 Conclusions

The teaming approach described above has worked very well at LLNL in implementing our safety program to meet current requirements. By involving the line and ES&H support organizations in developing and implementing policy and guidance, we achieve a balanced, cost-effective program with buy-in by the interested parties. This has not been easy to accomplish and our work is continuing. As more and more of our activities are regulated by external regulators (those not a part of DOE) the more disciplined the approach we must use to implement our safety program. Also, as the safety program becomes more driven by conformance to standards rather than expert judgment, all must work together to minimize the impact on the researchers and their ability to do timely research.

References

1. Grose, V. L., Managing Risk: Systematic Loss Prevention for Executives. Prentice Hall, New York, 1987
2. Strait, R. S., Risk-Based Prioritization: A Comparison of Approaches. Proceedings of PSAM-II, 1994; Vol. 2, 064-13- 064-18
3. Cummings, G. E., Strait, R. S., Risk Management at LLNL. Proceedings of PSAM-II, 1994; Vol. 1, 022-11- 022-16